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10EC55

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Information Theory and Coding

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, selecting at least TWO full questions from each part.

PART - A

- 1 a. Define:
 - i) Self Information
 - ii) Average Information
 - iii) Information rate. (06 Marks)
 - b. Find relationship between Hartleys, nats and bits. (06 Marks)
 - c. A code is composed of dots and dashes. Assuming that a dash is 3 times as long as a dot and has one-third the probability of occurrence. Calculate:
 - i) The information in a dot and a dash
 - ii) The entropy of dot-dash code
 - iii) The average rate of information if a dot lasts for 10 m-sec and this time is allowed between symbols. (08 Marks)
- 2 a. Explain the important properties of codes to be considered while encoding source with examples. (08 Marks)
 - b. Apply Shannon's encoding algorithm to the following set of messages and obtain code efficiency and redundancy. Write code tree for the code. (12 Marks)

M_1	M_2	M_3	M_4	M_5
1/8	1/16	3/16	1/4	3/8
- 3 a. Consider a source with 8 alphabets A to H with respective probabilities of 0.22, 0.20, 0.18, 0.15, 0.10, 0.08, 0.05, 0.02. i) Construct a binary compact code and determine the code efficiency ii) Construct a ternary compact code and determine the efficiency of the code. Compare and comment on the result. Draw code tree for all cases. (12 Marks)
 - b. A transmitter transmits 5 symbols with probabilities 0.2, 0.3, 0.2, 0.1 and 0.2. Given the channel matrix $P(B/A)$, calculate: i) $H(B)$ ii) $H(A.B)$. (08 Marks)

$$P(B/A) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1/4 & 3/4 & 0 & 0 \\ 0 & 1/3 & 2/3 & 0 \\ 0 & 0 & 1/3 & 2/3 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

- 4 a. Find the capacity of the discrete channel shown in Fig.Q.4(a).

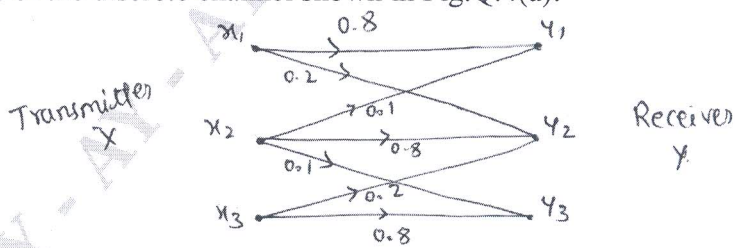


Fig.Q.4(a)

(10 Marks)

- b. State and explain the Shannon-Hartley law. Obtain an expression for the maximum capacity of a continuous channel. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

PART – B

- 5 a. If C is a valid code-vector then prove that $CH^T = 0$ where H^T is the transpose of the parity check matrix H . (06 Marks)
- b. For a systematic (6, 3) linear block code. The parity matrix 'P' is given by $P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$
- Find all possible code-vectors
 - Construct the corresponding encoding circuit
 - The received code-vector $R = [1 \ 1 \ 0 \ 0 \ 1 \ 0]$. Detect and correct the single error that occurred due to noise.
 - The received vector $R = [r_1, r_2, r_3, r_4, r_5, r_6]$ construct the corresponding syndrome calculation circuit. (14 Marks)
- 6 a. Define cyclic code. Explain how cyclic codes are generated from the generating polynomials. (06 Marks)
- b. A (15, 5) linear cyclic code has a generator polynomial $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$
- Draw the block diagram of an encoder and syndrome calculator for this code.
 - Find the code polynomial for the message polynomial $D(x) = 1 + x^2 + x^4$ in systematic form.
 - Is $v(x) = 1 + x^4 + x^6 + x^8 + x^{14}$ a code polynomial. (14 Marks)
- 7 Write a short note on:
- RS code
 - BCH code
 - Golay code
 - Burst error correcting code. (20 Marks)
- 8 Consider the (3, 1, 2) convolutional code with $g^{(1)} = (1, 1, 0)$, $g^{(2)} = 101$ and $g^{(3)} = 111$
- Draw the encoder block diagram
 - Find the generator matrix
 - Find the code-word corresponding to the information sequence (11101) using Time-domain and transfer domain approach. (20 Marks)

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